

BULLETIN

Pennsylvania Department of Agriculture
HARRISBURG, PA.

Vol. 12

September 1, 1929

No. 12

General Bulletin No. 481

The Hessian Fly in Pennsylvania

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Bureau of Entomology, U. S. Department of Agriculture



Harvesting Wheat in Lebanon County.

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Published monthly by direction of the Secretary. Entered as second class matter, March 22, 1918, at the Post Office at Harrisburg, Pa., under the Act of June 6, 1900. Accepted for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on June 29, 1918.

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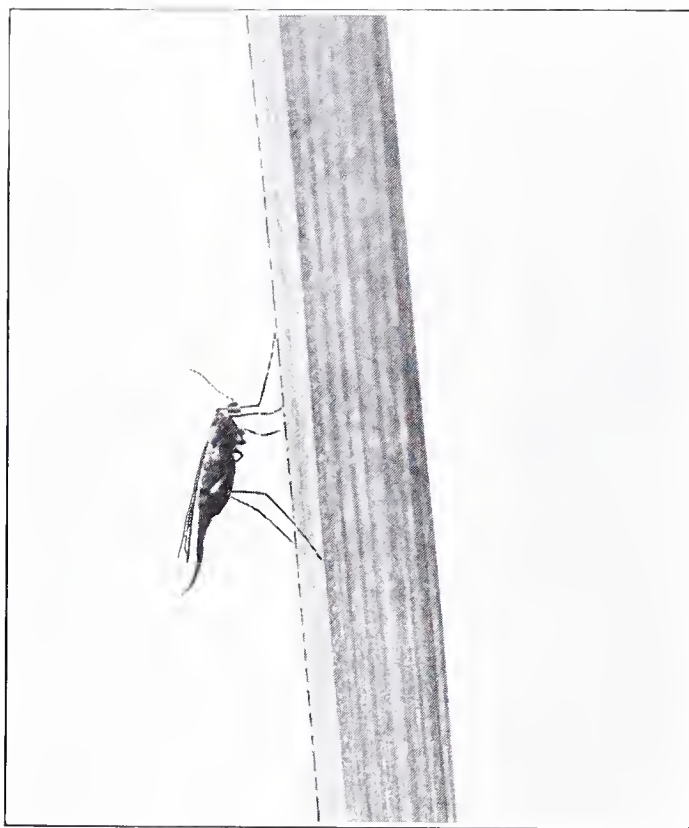


Fig. 1. Adult Hessian fly female at rest on wheat leaf.
(Greatly enlarged.)

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In many of the wheat growing counties of Pennsylvania infestations of Hessian fly have recently increased to a point which justifies attention from wheat growers. The present situation threatens heavy infestations of this pest for the next few years. It is, therefore, the purpose of this publication to provide information concerning the Hessian fly and methods of controlling it.

DESCRIPTION AND LIFE HISTORY

The adult Hessian fly (*Phytophaga destructor* Say) in appearance resembles a small mosquito. (See Fig. 1). It is short lived, its usual life span lasting less than a week. The average number of eggs laid by a female of the spring generation is 230; of a fall generation female, 285. The eggs are deposited in the grooves on the upper surface of the wheat leaves. The egg is elongate, reddish in color, and very minute, being just visible to the unaided eye. In the course of a few days the egg hatches and a small maggot or larva crawls down the leaf and underneath the sheath until it reaches a joint near the base of the plant. There it lodges and feeds by sucking sap from the stem. It is during this stage that damage is done to the wheat plant. In about three weeks it stops feeding and without changing its location, forms a brown case about itself called a puparium. It now has about the size and appearance of a flax seed. The longest period of its life is spent in this condition. Pupation takes place within this puparium and later the adult fly escapes from it.

*Acknowledgments are due to Mr. C. M. Packard and Dr. W. H. Larrimer, United States Bureau of Entomology to Dr. T. L. Guyton, Pennsylvania Bureau of Plant Industry and P. L. Edinger, Agricultural Extension Association, Cumberland County, Pa., for helpful suggestions and criticisms: also to the numerous farmers to whose careful work was largely due the success of the experimental plots.

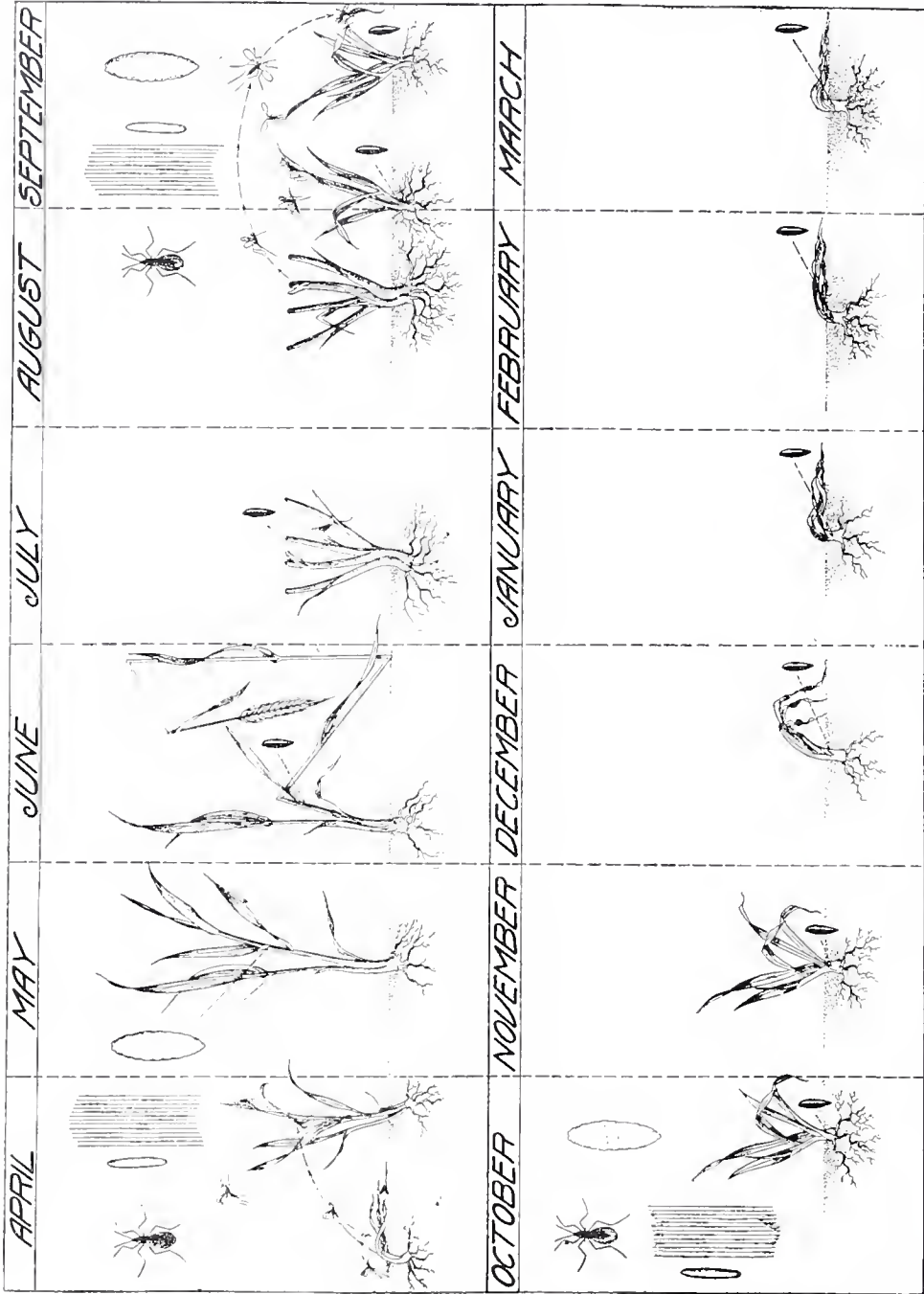


Fig. 2. Seasonal development of the Hessian fly from egg to adult twice during the year. The diagram shows the different stages of development and their position on the plant, the adults migrating from overwintering wheat plants to unfested plants in the spring, and adults migrating from stubble to young wheat plants in the fall. (After Webster.)

SEASONAL HISTORY

There are two main generations of the Hessian fly each year. These are shown in the life history chart, (Fig. 2). Flies of the first generation emerge and lay their eggs on the growing wheat during April and May. The resulting maggots develop into the puparium or "flaxseed" stage before the wheat is mature, and are found at the lower joints in the stubble in the fields after harvest. Most of the summer is spent in this stage. When stimulated by late summer or early fall rains these puparia in the stubble produce the second generation adult flies which usually come out most abundantly during

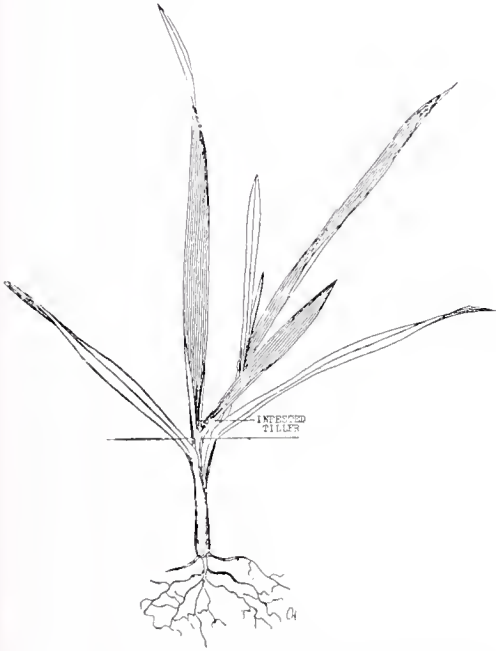


Fig. 3. Young wheat plant infested with Hessian fly in the fall of the year.



Fig. 4. Healthy young wheat plant.

September. Volunteer wheat and wheat sown before the fly-free date, become infested with the young produced by this generation. By the time cold weather arrives this fall generation of maggots has finished feeding and entered the inactive puparium form in which it passes the winter hidden under the leaf sheaths of the young wheat. Small secondary broods commonly emerge during the summer and mid-fall but these are usually not of sufficient proportions in Pennsylvania to do much harm.

NATURE OF INJURY

In the fall of the year, heavily infested wheat plants are often entirely killed and almost invariably the tiller upon which the fly maggot is lodged is killed outright. The appearance of a young infested plant is very characteristic. The leaves come out broader, more upright and assume a darker, more bluish-green color than

normal. The central shoot is usually absent. Figure 3 shows a typically infested plant as compared with a normal plant shown in figure 4. Figure 5 shows a wheat plant as it appears at the close of winter having one dead tiller infested with Hessian fly puparia. A heavily infested field of young wheat has a very straggly appearance. A typical example of such a field photographed the 9th day of May is shown in figure 7. The work of the spring generation of the fly reduces the weight of the grain and causes some tillers to be entirely unproductive. Much loss of grain is also due to lodging caused by the stem being weakened at the point where the "fly" larva has been feeding. This type of damage is shown in figure 6.

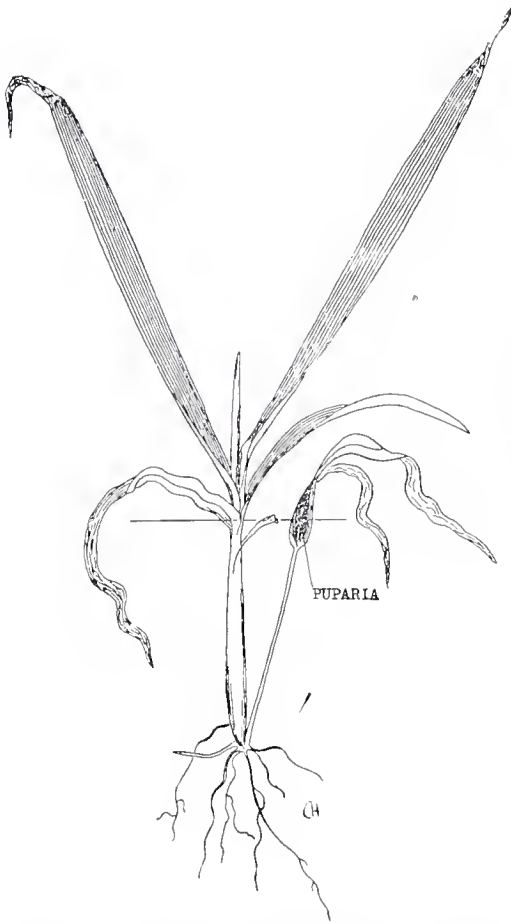


Fig. 5. Young wheat plant infested with Hessian fly, as it appears in late winter or early spring, before renewed growth has started. The Hessian fly puparia are lodged in the dead culm below the soil line.

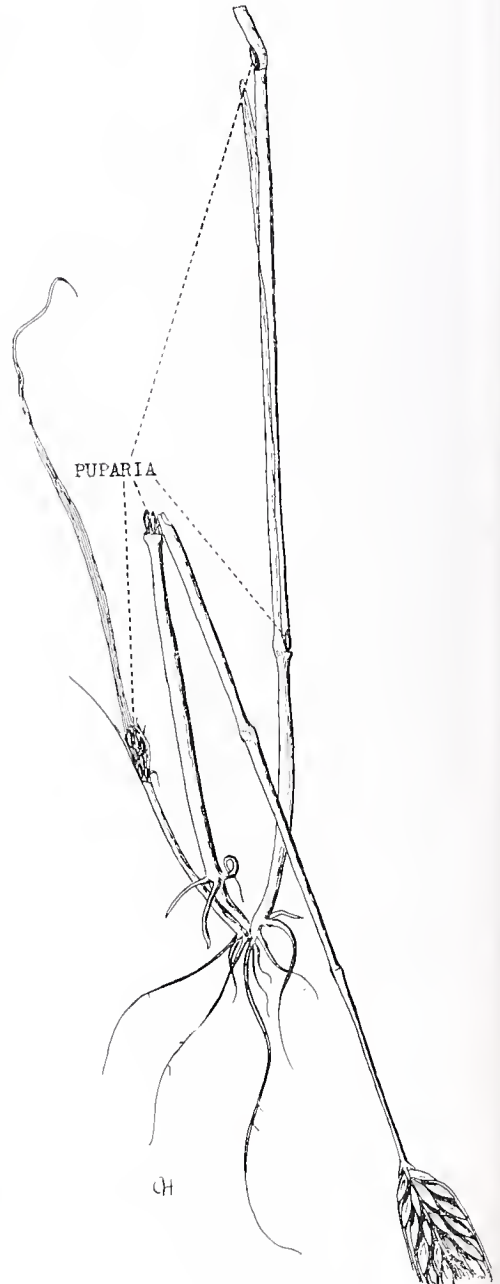


Fig. 6. Hessian fly puparia in wheat stubble, showing two puparia at nodes in a stubble cut by a reaper, a wheat culm broken over by the effects of Hessian fly, and puparia in a stunted tiller. The leaf sheaths have been peeled away to show the puparia

HISTORY OF THE HESSIAN FLY IN PENNSYLVANIA FROM 1921 TO 1928

In order to better understand the present Hessian fly conditions in Pennsylvania a brief review has been made of the occurrences of the pest during the years from 1921 to 1928. Figure 8 shows the annual relative abundance of the spring generation as it occurred on consecutive years during this period, and figure 9 is a similar comparison of the annual abundance of flies of the fall generation as found in the young wheat in the fall of the year. The data for these surveys were obtained by the examination of a number of fields, usually ten, taken at random in different parts of each county entered. In the fall survey, late planted fields which were uninfested, were impartially included, in order to obtain an unbiased estimate of the extent of infestation.



Fig. 7. Field of wheat near Mt. Holly Springs, Pa., as it appeared in the spring of 1928, heavily infested with Hessian fly.

It may be seen by reference to these diagrams that there is a sharp increase in infestation ranging from a point of insignificance during the first six years under observation to one of serious abundance in 1927. The cause of this increase can be traced to the occurrence of an unusual abundance of volunteer wheat during the late summer and fall of 1926. Comparison of annual survey notes on fly conditions in Pennsylvania which have been made by the representatives of the U. S. Bureau of Entomology during the past eight years showed conclusively that volunteer wheat was much more abundant in 1926 than in any previous year under survey. Moreover, U. S. Weather Bureau records show the occurrence of nearly two inches (1.86 inches) more rainfall in the state of Pennsylvania during the month of August in 1926 than during the same month of any single year since 1920. As this month is the critical growing period for volunteer wheat, the increase of rainfall probably largely accounts for the exceptional abundance of

volunteer wheat that occurred during that year. This same excess amount of moisture also stimulated Hessian fly activity which resulted in the heavy infestation of the volunteer wheat.

In order to ascertain the extent of Hessian fly infestation that occurred in the volunteer wheat during the late summer and fall of 1926, samples were taken from 14 counties, and out of 1,481 plants examined 36 per cent were found infested. The intensity of infestation amounted to 3.24 flies per plant. Some of the fields showed 100

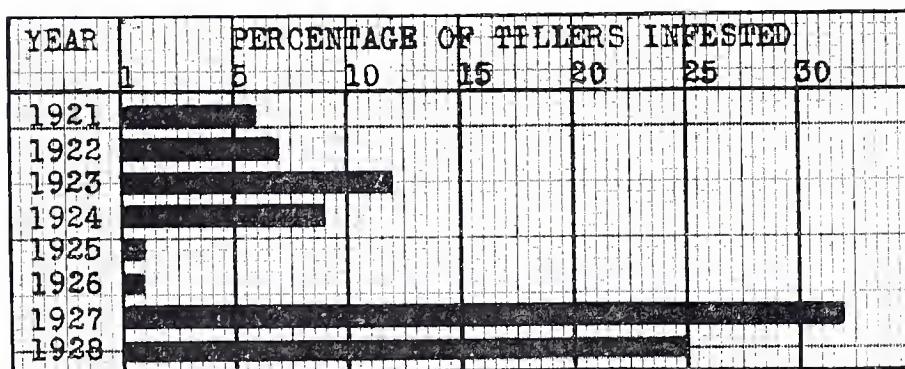


Fig. 8. Relative abundance of the spring generation of the Hessian fly in Pennsylvania for the years 1921 to 1928, showing the percentage of tillers infested per county.

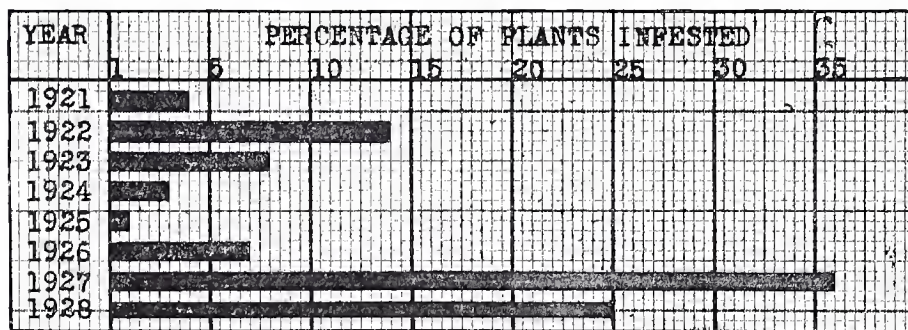


Fig. 9. Relative abundance of the fall generation of the Hessian fly in Pennsylvania for the years 1921 to 1928, showing the percentage of plants infested per county.

per cent of the volunteer plants infested and in one instance the intensity amounted to over four Hessian fly puparia per plant. This rapid increase in fly abundance arose from the apparently negligible infestation of 1 per cent or less which was present in the stubble of the 1926 crop and presaged a serious increase of flies for the spring of 1927. This increase actually occurred during 1927 as shown in figure 8.

The slight increase of infestation in the fall of 1926 was to some extent due to a partial intermediate emergence of flies from volunteer wheat. The heavy infestation in the fall of 1927 was anticipated because of the great abundance of flies of the spring generation ready to emerge from the wheat stubbles.

Fig. 10. Hessian fly infestation in the young wheat in Pennsylvania in the fall of 1928.

PARASITES

The parasites are an important natural check to the Hessian fly, but cannot be depended on to keep it under control and successful artificial means have not yet been devised to employ parasites as a controlling factor during Hessian fly outbreaks.

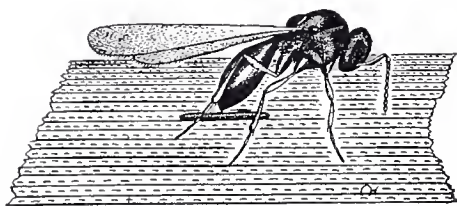


Fig. 11. *Platygaster vernalis* Myers, a parasite of the Hessian fly, ovipositing into a Hessian fly egg. (Greatly enlarged.)



Fig. 12. *Platygaster vernalis* Myers, cocoons in a Hessian fly puparium. (Greatly enlarged.)

METHODS OF CONTROL

Control measures should receive community action in order to get effectual results. Wheat fields free from the fly on one farm are likely to be reinfested in the spring by flies coming in from neighboring farms where means of control have been neglected. The following measures are recommended:

(1) Where practical and other crops are not thereby injured, destroy all volunteer wheat whenever it appears by discing, harrowing, or other means and thus prevent the fly from becoming established on it.

(2) Practice crop rotation and thus avoid sowing wheat on wheat stubble.

(3) Prepare a good seed bed, use good seed and make sure that the soil is sufficiently fertile to furnish all the proper nourishment that the young wheat plants can use.

(4) Last and most important, sow wheat on or soon after the date recommended as safe from damaging Hessian fly infestation. Such dates are listed in Table I. Only those localities have been mentioned where experimental plots have been run, but these dates may be used as a guide for neighboring wheat growing regions of similar altitude and latitude. This recommendation should be strictly followed during years of abundant infestations but it should be borne in mind that wheat should always be sown sufficiently early to withstand the winter. Adherence to this rule not only saves the immediate crop from damage by the fly during the fall and winter but reduces the amount of fly which will emerge to infest the wheat plants in the spring. Figure 13 shows the difference in amount of injury between an early sown strip of young wheat badly damaged by Hessian fly, as compared with a strip of wheat sown later and which consequently escaped much Hessian fly infestation.



Fig. 13. Photograph showing the appearance in the fall of the year of an early sown strip of wheat (on the left), badly damaged by Hessian fly because of heavy infestation, as compared to a strip of wheat (on the right) sown later and consequently escaping much Hessian fly infestation.

Table I. Recommended safe dates on or after which wheat should be sown to escape damaging infestation from the Hessian fly.

<i>County</i>	<i>Location</i>	<i>Date</i>
Bedford	Bedford	September 27
Berks	Kutztown	September 28
Butler	Cabot	September 23
Cumberland	Mt. Holly Springs ..	October 1
Indiana	Indiana	September 20
Lycoming	Montoursville	September 25
Mifflin	Lewistown	September 30
Northumberland	Sunbury	September 26
Washington	Canonsburg	September 25
York	Red Lion	September 30

To obtain the best yield and avoid possible failure of the crop when following out the recommendations given for sowing wheat on or after "fly-safe" dates, the following points should be borne in mind:

1. In those regions where the soil commonly heaves out the plants and causes yearly damage from winter-killing especial care should be taken not to sow too late. In such localities rigid observation of the "safe date" recommendation need only be observed during the years of considerable or heavy Hessian fly infestation.

2. Late sowing to avoid "fly" at the expense of a good stand of wheat is never recommended for any locality. However, if the wheat is sown reasonably soon after the date given, danger due to late sowing will not ordinarily occur.

3. The date of sowing should be adjusted to suit the elevation of the land. Lower elevations require later sowing and on higher elevations the sowing should be earlier.

